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Autonomisation des communautés avec le Programme d'expansion des entreprises Musa spp au Nigéria

Potenciación de la comunidad gracias al Programa de Expansión Empresarial Musa spp, Nigeria

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Community Empowerment with Musa spp Enterprise Expansion Programme, Nigeria

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Abstract. This study was designed to identify implementation strategies and approaches that contributed to the success of the expansion of hybrid plantain/banana (Musa spp) enterprise programme in Rivers State, Southern Nigeria. Forty contract farmers directly involved in the project were selected. Primary data were generated through the use of structured questionnaires, while secondary data were obtained from published and unpublished materials from the International Institute for Tropical Agriculture. Data analysis involved qualitative techniques, descriptive statistics, the Kolmogorov-Simirov test gross margin analysis, and t-test. Farmers preferred workshops and services of extension agents to other modes of technology transfer. Strategies/approaches were tailored towards overcoming constraints to the success of the project. Farmers were organized in groups based on their residence so that they could have easy access to demonstration plots. A cost sharing approach was adopted where farmers donated parcels of land as demonstration plots while the funding agencies provided the improved breeds and technical knowhow. Training programmes involved field trips and workshops. This study demonstrated that the use of cost sharing formulae helps in the success of an extension programme. It was recommended that community development programmes should adopt some level of cost sharing formulae, work in line with established and prevalent cultural patterns and community institutions, and encourage cooperation among farmers to avoid lack of interest or poor acceptance of innovations and projects.

Keywords. Community empowerment, plantain/banana hybrid, small-scale enterprise

1. Introduction

The southern part of Nigeria can be called the plantain/banana belt of the country. This is because the area possesses suitable edaphic and climatic conditions for growing plantain and bananas. The crops are among the major ones grown in this part of the country. Plantain, bananas and cooking bananas, whose genotypes are designated as AAB, AAA and ABB, respectively, are species of the genus *Musa* and are referred to as *Musa* spp (Vuylsteke et al., 1997). The importance of plantain/bananas is underscored by the fact that they are among the major staple food throughout the humid tropics of the world (Chandler, 1995). Unripe plantain/bananas are sources of iron, while ripped ones provide mainly energy. Plantain/bananas are also sources of vitamin A, B6 and C as well as potassium (Anonymous 1991). They are easily digestible and as such can serve as part of the first solid food given to infants. Ripe bananas can be served as a dessert.

Plantain/bananas are high yielding crops, which form an integral component of the taungya farming system/Agro-Forestry in tropical Africa (Nweke et al., 1988, Swennen, 1990). Although plantain/bananas produce fruits throughout the year, the major harvest occurs in the dry season (December to March). During this period, many food crops are in short supply or difficult to harvest. Plantain/bananas thus play a vital role in the food security need of millions of people (Alves, 1985). This is the case in Africa, which produces 70.8% of the world plantain/banana output (FAO 1987) and 25% of the total energy need of 70 million people (Samson 1980). About 80% of plantain/bananas produced by Nigerian farmers are for market consumption and this accounts for more than 30% of total farm income (Olorunda, 1986).

Major problems limiting the production of plantain/bananas include the sigatoka diseases. This takes two forms; namely, yellow sigatoka caused by *Mycosphaerella musicola* which is a fungal leaf spot that can reduce the yield by 30 – 50%, and black

sigatoka whose pathogen is *Mycosphaerella fijiensis* which causes defoliation by leaf necrosis (Stover and Simmonds, 1987; INIBAP, 1996). The outbreak of black sigatoka disease in the early 1980s seriously threatened the livelihood and welfare of the millions of people in southern Nigeria and Rivers state, in particular, that depended on plantain/bananas. The devastation caused by the disease on the crops led to monumental yield reductions by at least 50%, and in the most severe cases it wiped out the entire plantain/bananas in the field (IITA, 2003). The best alternative approach for control of sigatoka diseases in plantains is through the breeding of resistant hybrids. This is because sigatoka pathogens are fungi, and small-scale farmers lack the financial capacity to purchase suitable fungicides used by commercial producers and exporters in Africa.

The plantain/banana improvement programme was established in 1986 following the outbreak of black sigatoka disease. It was specifically aimed at solving the problems associated with plantain/banana production in Africa (IITA, 1998). The International Institute for Tropical Agriculture (IITA), in collaboration with other Agricultural Research Centers such as the Foundation for horticulture and Agricultural investigation, and the Center for research on plantains and bananas in Cameroon embarked on the development of high yielding disease resistance varieties that out yield the best land race by about 100%, with a high level of tolerance to the virulent disease (IITA, 2003b).

Some of the newly developed hybrids had successfully undergone field trials in multi-ecological locations through National Agricultural Research and Extension System in Nigeria (NARES). However, problems limiting expansion of hybrids of plantain/bananas are low pace of awareness, and acceptance and adoption of the technology. Effective processing and marketing skills of the hybrid products such as flour, chips, wine, and jam puree were also part of the problem. This is because the organoleptic properties of the hybrid products are different from those of the land race. In other words, apart from introduction of the hybrids to farmers, their processing and utilization were not known to the public, which resulted in low market for the farmers (Ewujowoh, 1994).

Most information available to extension officers comprises agronomic practices with little or no information on processing of the produced hybrid plantain/banana fruits. Thus, despite the nutritive quality, higher yield and disease resistant ability of the hybrids, their trials and adoption were very limited. Low adoption level of the technology can be attributed to poor learning process and quality of knowledge disseminated (Diermanse et al., 2006). To solve these problems, in the year 2000, the United States Agency for International Development (USAID) graciously provided support to IITA with which the plantain/bananas expansion programme was lunched on a large-scale (IITA, 2003b). IITA, in collaboration with Plantain and Bananas Development Programme (PBDP) of the Federal Ministry of Agriculture and National Horticultural Research Institute (NIHORT), served as the nucleus of the programme. The programme involved delivery of hybrids of plantain and banana suckers and other inputs, dissemination of information on improved agronomic practices, sucker multiplication techniques, and post-harvest storage and processing techniques. Ever since the commencement of the programme, research has not fully documented the experiences in the Rivers State of Nigeria. For instance, available literature has not provided concise answers to the questions such as: What problems did the project face? What implementation strategies made the project a success in Rivers State?

2. Objectives

The study aimed at documenting: (1) objectives of the project and implementation strategies used to execute the programme/projects in Rivers state; (ii) determination of appropriate channel of transfer of technology from research centres to farmers; (iii) identification of obstacles to the success of the projects and strategies used to overcome them; (iv) identification of the post-harvest/processing technologies disseminated to the farmers; (v) assessment of the acceptance of the hybrid products since the implementation of the programme; (vi) assessment of the profitability of the enterprise; and (vi) recommendations based on the findings.

The null hypothesis that guided the study was that there is no preference among farmers in their choice of channel for transfer of technology of hybrids of plantain/banana (*Musa* spp).

3. Methodology

The study area: The study was conducted in Rivers state of Nigeria. Rivers state was purposively selected because it was one of the states that benefited from the hybrid plantain/banana production expansion programme funded by USAID. In addition, the state hosts the IITA High Rainfall Station which is located in Onne-Rivers state. The primary occupation of people in the rural areas of the state is farming, and small-holder farmers dominate the farming population. Major arable crops grown are plantain and banana, cassava, maize, as well as vegetables.

Sampling procedure: Multi stage purposive sampling techniques were used. This was in order to select the primary contract[1] and collaborative contract farmers involved in the programme. **Stage (I)** involved the purposive selection of three local government areas that benefited from IITA hybrid plantain/banana expansion programme, **Stage (II)** was the purposive selection of 4 communities namely Okwale, Ogbidi, Idu and Igwurinta 1 & 2 based on the fact that they are areas where plantain/banana production is the major farming enterprise . **Stage (III)** was the purposive selection of 40 farmer respondents made up of 4 primary contract farmers and 36 collaborative contract farmers. This means that 10 respondents made up of 1 contact farmer and 9 collaborative farmers were selected from each of the 4 communities.

1 In Nigerian Agricultural Extension System, contact farmers can serve as contract farmers because the contact farmers are clientele to the extension staff.

4. Data Collection and Analytical Techniques

Primary data were collected through the use of structured questionnaires, oral interviews and observation of field activities. Secondary data were collected from relevant texts, journals and other materials including publications of IITA. Data were analysed using qualitative techniques, descriptive statistics, gross margin analysis and t-test, while the hypothesis was tested using Kolmogorov – Simirov (K-S) one sample statistics. The K-S test was used to determine if any preference existed in the choice of communication channel for transfer of technology to farmers. The format and decision rule are stated as:

$$D^* = \text{Max } /S_{n(x)} - F_{o(x)}/ \leq D\ (1-\alpha;n) \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where: Max = Maximum; D* and D (I-α;n) = Calculated and tabulated;

K – S statistics at α probability level for n number of observation respectively, measured as $/S_{n(x)} - F_{o(x)}/$ = absolute value of difference between observed cumulative and calculated probability frequencies respectively. If D* is ≥ D (1-5%, 40), there is no preference for channels of communication for transfer of technology among the farmers.

The implicit format for gross margin analysis per kg of plantain flour or chips is given

as: $\dfrac{\text{Total Revenue(TR) - Total variable cost (TVC)}}{\text{1kg of plantain flour or plantain chips.}}$

In addition, paired sample t-test was used to determine difference in income from improved and local cultivars. The format for the t-test is given as:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\dfrac{(n_1-1)S_1^2 + (n_2-1)S_2^2}{(n_1+n_2)-2}}} \ldots\ldots\ldots\ldots(2)$$

Where: $\overline{X}_1$ and $\overline{X}_2$ are the mean income from improved and local cultivars respectively,

S_1^2 and S_2^2 are the variances of income improved and local cultivars respectively,

n_1 and n_2 are the number of farmers selling improved and local cultivars respectively.

5. Results

5.1 Objectives and Implementation Strategies

The implementation strategy was anchored on major objectives of the project which were arrived at during a stakeholders workshop held in September 2000 at the IITA High Rainfall station in Onne, Rivers state and subsequent meetings with IITA PBDP and NIHORT, in consultation with PHIA and INIBAP. The key objectives and strategies were:

1. Distribution and on-farm evaluation of black sigatoka resistant hybrids and training of farmers. These were achieved by
   a) Establishment of demonstration plots and monitoring of the plots.
   b) Distribution of planting materials on farmer's field days and training farmers in sucker multiplication techniques.
   c) Provision and distribution of training manuals and assisting community based organizations (CBOs) as well as individuals to set up Sucker Multiplication Centers (SMCs).
2. Dissemination of improved agronomic practices, alternate post-harvest technologies in processing and marketing of the hybrid products through workshops and training.

5.2 Implementation Approach and Rationale for the Choice

The project adopted a rural, farmer-participatory and community based technology delivery approach in close collaboration with the National Agricultural Development Programme and Non Governmental Organizations (NGOs). These approaches were based on the facts and concepts that (i) adoption of technology is strongly influenced by members of social groups; (ii) farmers are keen observers of other farmers' activities and know how to get good yields or good results by imitating those who experimented with new methods; (iii) people tend to accept new ideas most easily along with their peers and (iv) many innovations can originate either from farmers or modified by them to suit their situations.

Table 1. Distribution of OFDPs and VMTs in Rivers State (Source: Field Data, 2004/2005)

LOCAL GOVERNMENT	COMMUNITIES	NO. OF FARMERS PROVIDING THE LAND	OFDPS (HA)	VMTS (HA)
Oyigbo	Okwale	1	0.12	0.12
Ogba/ Egbema/ Ndoni	Idu	1	0.12	0.12
Ogba/ Egbema/ Ndoni	Ogbidi	1	0.12	0.12
Ikwere	Igwurinta 1	1	0.12	0.12
Ikwere	Igwurinta 2	1	0.12	0.12
Total	5	5	0.60	0.60

5.3 Establishment of the Plots

Establishment of farmers' plots commenced in June 2001; each primary contract farmer for the project had two plots of

about 0.12 hectares (ha) each for the establishment of Varietal Mixture Trials (VMTs) and On Farm Demonstration plots (OFDPs). The VMTs were designed for the hybrids to act as biological control against the incidence of disease on farmers' local varieties thereby improving their yields. It also allows the farmers to make a good comparison of yields of local varieties with the hybrids as well as preserve the land race for further genetic studies and uses.

The OFDPs were designed to enable farmers to assess the performance of the various hybrids along with their best local variety so as to make comparison and selection.

Supply of Logistics: A total of 226 hybrid suckers of plantain and banana were made available to the primary contract farmers of the programme in Rivers state free of charge. They were planted at 2m x 3m apart. Farmers were assisted with subsidy for labour as well as fertilizers made available through collaborating institutions. Funds were made available for field monitoring and up keep of the VMTs and OFDPs.

5.4 Constraints to Success of the Project and Strategies Adopted

The list of constraints and strategies adopted are presented in Table 2. Cultural setting reflecting in scarcity of land and mixed cropping system as well as inadequate awareness, shortage of planting materials and loss of interest were the major problems encountered. These problems differ from those found by Jin-Mo et al. (2009) in Korea. They noted that the challenges extensionists face included making Korean agricultural extension to be mainly for farmers and consumers. It is possible that in Korea, people who should not have access to the extension services are benefiting from it. But in Nigerian agricultural extension systems already know how to identify their clients.

Table 2. List of Constraints and Strategies Adopted (Source: Field Data, 2004/2005)

S/N	CONSTRAINTS	STRATEGIES ADOPTED
i	Scarcity of land	VMTs & OFDPs were reduced to 0.12 ha
ii	Mixed cropping systems dominate	Farmers were encouraged to inter crop the hybrid suckers with other arable crops
iii	Shortage of planting materials led to reduction of pace technology adoption	Production and distribution of hybrid suckers by seeds multiplication techniques.
iv	Inadequate awareness	Traditional institutions and the state ADP were engaged to publicize the programme
v	Loss of interest in the new technologies	Regular contact of target groups by agricultural extension agents.

5.5 Workshop/Training/Field Trips

Training covered areas of special interest in agronomic practices including sucker multiplication and management techniques and post –harvest technologies such as processing of produce into chips, flour, wine and juice as well as packaging and marketing strategies. Processing of hybrid produce into flour takes place during the dry season (October to March). Interestingly, this period coincided with the peak harvesting period. Processing of produce into chips takes place anytime. Chips and flour attracts higher income during period of scarcity. Table 3 showed that the peak of proportion of farmers in attendance was recorded during the harvesting period (dry season) than during the planting season (rainy season). It indicates that farmers will prefer to attend workshops during the months they have less on-farm time bound activities such as cultivation planting and weeding.

Table 3. Work Shop schedule, Location and Number of Participants Workshop/Training/Field Trips (Source: Adopted from IITA 2003b)

MONTH	LOCATION	NO OF PARTICIPANT (FARMERS)	%
September 2000	Onne	42	12.1
December 2000	Onne	30	8.7
May 2001	Onne	20	5.8
November 2001	Okwale	31	8.9
September 2002	Onne	157	45.2
December 2002	Onne	57	16.4
May 2003	Onne	10	2.9
Total		347	100.0

Beside the scheduled training/workshop days, the extension officers were assigned to conduct regular visit and monitoring of the VMTs and OFDPs in collaboration with the primary contract farmers on whose farm lands the plots were established. Both the Primary and collaborative contract farmers were trained during workshop and field visits on OFDPs and VMTs.

Farmers prefer different channels for information dissemination. In order to make the farmer adopt a target technology, the preferred technology transfer channel is not to be taken for granted. Information channel preference is shown in Table 4.

Farmers showed preferences with respect to transfer of technology. The preferences are the use of workshops (50%); by extension agents (25%) other farmers (20%) and the media (5%) (Table 4). The calculated K-S statistics at 5% probability level for 40 observations is 0.500 which is greater than the tabulated one (0.215). This partially explains why there was very low adoption of the technology prior to the provision of fund by USAID for expansion of the programme, which largely made use of workshops and extension agents. The preferences in

choice of transfer of technology showed that farmers' learning strategies are different. In fact Karbasioun et al. (2008) have noted that farmers' learning strategies differs in Province of Esfaha Karbasioun et al. (2008).

Table 4. Frequency Distribution of Farmers According to their Preferred Source of Information on Technologies (Source: Field Data, 2004/2005)

SOURCE OF INFORMATION	NO OF RESPONDENTS	PERCENTAGE
Media	2	5
Other farmers	8	20
Extension agents	10	25
Workshops	20	50
Total	40	100

5.6 Income Generation to Farmers by the Project

Income generated involved cash awards, sales of suckers and bunches of plantain/bananas as well as plantain flour and chips.

Cash Awards: Cash awards were given to outstanding/ successful farmers during farmers' day exhibitions and world food day programmes to boost the competitive spirit in the adoption of the hybrids and recommended technologies.

Marketing of Suckers: The Primary and collaborative contract farmers rapidly multiplied suckers for sale using the sucker multiplication improved technologies gained through workshops. Hybrid suckers were sold at ₦50.00 ($0.33) or ₦60.00 ($0.4). Each of the average small-scale farmers can multiply up to 50 suckers within 3 months.

Marketing of processed hybrid products:
Plantain flour and chips are sources of higher income to farmers. Table 5 illustrates distribution of farmers by the hybrid produce sold.

Table 5. Distribution of Respondents According to Products of Hybrids Sold (Source: Field Data 2004/2005)

PRODUCTS	NO. OF FARMERS*	PERCENTAGE
Flour	27	67
Chips	30	75
Suckers	40	100

* Multiple responses recorded, maximum responding unit is 40 persons.

Comparative analysis of income generation by hybrids and local varieties bunches of hybrids are larger and attracts higher prices than local varieties/land race. Table 6 illustrates this.

Table 6. Distribution of Respondents According to Average Bunch Price Earned from Hybrids and Local Cultivars of Plantain/Bananas (Source: Computed from Field Data, 2004/2005)

PRICE RANGE (N)	HYBRID CULTIVARS	LOCAL CULTIVARS	PERCENTAGE FOR HYBRID CULTIVARS
<100	0	7	0.0
100 – 199	3	10	7.5
200 – 299	5	15	12.5
300 – 399	14	8	35.0
400 – 499	10	0	25.0
500 – 599	8	0	20.0
Total	40 %	40 %	%

The explanation of the differences in the gross margins is based on the fact that hybrids possess more dry matter per gram than local cultivars. Additionally, given that the same resources are employed in processing of plantains to flour or chips, the quality of the hybrids products attracts higher prices than those of local cultivars. The cost of items considered were: cost of plantain bunches, peeling and washing, milling/ chopping, cost of drying or frying, and transportation; while the revenue were sales of 1kg of plantain flour and 1kg of plantain clips. Table 7 shows that 51 and 68.6 percent gains were made by processing hybrids of plantain into flour and chips respectively instead of processing local cultivars. According to Leonardo *et al.,* (2010) before farmers fully adopt a new technology, they need to confirm that the new technology is significantly superior to the existing system and could provide a secure income. Table 7 shows that the project satisfied this criterion.

The study examined the Rivers State experience of community empowerment through economic and technical assistance with Hybrid plantain/Banana (*Musa* spp) enterprise expansion programme funded by USAID in southern Nigeria. Plantain/Banana are major food crops in the State. It has been illustrated that success of the programme was based on: implementation strategies that were strictly used to achieve specific objectives of the programme,

Table 7. Comparison of Revenue from Processed Land Race and Hybrid Cultivars (Source: Computed from Field Data 2004/2005. Practical Implementations)

CULTIVARS	GROSS MARGIN/KG FLOUR	% INCOME DIFFERENCE FROM CULTIVARS	GROSS MARGIN CHIPS KG.	% INCOME DIFFERENCE FROM CULTIVARS
Local cultivars	N220.45	51	545.00	68.6
Hybrid cultivars	N 432.08		795.00	
Paired t- test (p-value)	0.000***		0.000***	

*** = sig at 1%;

rationale for implementation approach were based on facts about behaviours of people with respect to adoption of technologies, the approach which also was in consonance with the prevalent cropping systems due to land scarcity helped farmers to adopt the technology in order to meet their food security need.

The project demands on farmers especially with respect to provision of land were reasonably what the farmers can provide and provisions were made for 2 farmers each to provide one piece of land of about 0.12 hectares where one farmer can not provide two 0.12 hectares of land for OFDPs and VMTs respectively. Hybrid suckers, fertilizers and training were provided free of charge, also labour was subsidized for establishment and maintenance of OFDPs and VMTs plots on farmers' lands. Extension agents were constantly encouraging farmers to adopt the new technologies. It was determined that farmers preferred workshops and services of extension agents as information channels for transfer of technology to the media and co-farmers. The hybrid produced attracted higher income to the farmers. The projects demonstrated that learning styles and strategies can not be taken for granted, (Biemas et al. 2008; Karabasioun et al. 2008)

3. Recommendations

The work has demonstrated that flexibility, and bottom–top approaches are essential in extending technologiess. It further highlighted the need to involve farmers in establishing training plots and awards for outstanding performances to increase motivation for adoption of the technology. It showed that cooperation among farmers, linking extension system to the community institutions and cost sharing strategy are ways to success with extension systems in developing countries. This is because farmers cooperated to use plots donated by 5 members of the community thus removing the cost of acquisition of land from the project sponsors. Chukwuone, et al. (2006) noted that lack of cooperation among farmers and lack of effective cost sharing formulae for execution of agricultural projects were among the limitations of success of extension in Nigeria. Land is an important factor in agriculture and scarcity of land has impeded development of agricultural enterprises in Nigeria (Mkpado and Arene, 2003; Oreuja et al. 2007). The approach adopted thus minimizes the effects of land scarcity, thus reducing the risk farmers have with respect to land acquisition. It may be informative to note that the plots served as part of the community access during the implementation, thus helping to build strong community institutions for extension. Consequently, the following recommendations were made:

1. Implementation strategies and approaches to development programmes should be flexible and strictly aimed at achieving specific objectives as well as overcoming obstacles to the success for the projects. Such an approach makes the programme objective driven and obstacle dismantling as well as sensitive to needs of different situations.
2. Community development programmes should not be against the prevalent cultural pattern to avoid lack of interest or acceptance and minimal support for the projects.
3. Community empowerment intervention should not demand more than what the populace can offer in order for the project to reach the target people and enhance adoption of the technologies of the project.
4. Cooperation among the farmers and building strong community institutions for extension transfer should be encouraged.
5. Technologies that will earn farmers higher income should be transferred to them using workshop and extension agents because they prefer these information channels to others.

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7. Editor's notes

The view expresses in this paper are the authors and do not reflect that of their institution affiliations.

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